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## Influence of water blocking material on the performance and conductivity of aluminium conductors

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### ABSTRACT

*The major concern for the reliability of subsea cables is corrosion.*

*The influence of corrosion on different constructions will be highlighted especially due to component tapes. Many tapes contain additives such as super absorbent polymers (SAP) that do not work in saltwater and degrade very quickly without any saltwater absorption. A newly developed SAP has been tested for this application. Based on work performed some years ago [1] work evaluating different water blocking materials has continued on Type H11 aluminium conductors as the conductor material.*

*Two different SAP-materials were used as water blocking agents:*

- *One designed for sweet water and the other one designed for saltwater applications.*
- *The two materials used were different compounds based on epoxy resins and modified Styrene-Ethylene-Butylene-Styrene-Polymer (SEBS).*

*One material was semi-conductive and the other insulating. This paper highlights the influence of water-types (sea and sweet) on the performance of cables, especially the conductor. In addition, degradation of the water blocking agents is assessed during these tests.*

### KEYWORDS

Subsea cables, water blocking, corrosion.

### INTRODUCTION

Water blocking of the conductor is essential to ensure long life of a cable system particularly if there is damage to the overall cable structure. Longitudinal flow of water is blocked inside the cable and in fact, horizontal flow of water would normally be blocked, but this was not a direct part of this evaluation. Some evaluation has already been reported during Jicable 2019 [1].

Aluminium itself is a very inert material, particularly against corrosion. It immediately reacts to form aluminium oxide on the surface which creates an inert thin layer protecting the metal from further oxidation. The San Gioachino Church in

Rome has been successfully protected with an aluminium roof for more than 120 years.

However, aluminium, and aluminium oxide are very sensitive to changes in the pH level of the surroundings and due to its very non-noble property it is very susceptible to the addition of impurities. These impurities can be copper, sodium salts, and graphites. All three very common in subsea cable installations.

Copper impurities can be accidentally added during the production of an aluminium conductor for example, if separation from a previous copper conductor production is not complete.

Contradictory to common belief, high purity aluminium alloys do not have significant resistance to corrosion. For example, AA1199, one of the highest purity grades, does not have atmospheric corrosion resistance.

Also, graphite or carbon black addition during manufacture should be done with care where a change of the pH value is very important. There are carbon blacks that are basic and there are types that have an acid character. Adding sodium chloride to this mix creates the perfect environment for problems. Sodium is a component that is present in most of the super absorbent polymers and occurs naturally in seawater. And in addition, chlorine will come from PVC or the seawater.

### TEST SET UP

The test samples used were aluminium wires of type H 11 quality. The properties of these wires are outlined in Table 1.